ELEMENTARY SCIENCE CURRICULUM
K-5

Catholic Schools Office
Diocese of Phoenix
2015

ELEMENTARY SCIENCE CURRICULUM

Diocese of Phoenix

MaryBeth Mueller, Ed. Specialist
Executive Director
Division of Education and Evangelization
and
Superintendent of Schools

Colleen McCoy-Cejka
Assistant Superintendent

Domonic Salce
Assistant Superintendent

Catholic Schools Office
Diocese of Phoenix
400 East Monroe Street
Phoenix, AZ 85004
(602) 354-2345
www.catholicschoolsphx.com

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It is with much gratitude and praise that the Catholic Schools Office of the Diocese of Phoenix would like to recognize and thank the Elementary Science Curriculum Committee. In times when school curriculum is being more carefully scrutinized by the public and revised more meticulously by educators in ways that will greatly impact the rigor of our Catholic school educational programs, this committee has done excellent work creating Diocesan science standards that are robust in content, reflective of interdisciplinary goals set forth in the English Language Arts standards, and reflective of core Catholic values.

As Catholic educators, we value the perspective that science provides in the lens of our Catholic worldview. Our revised curriculum stresses the value we place on student inquiry, critical thinking and questioning, open-minded investigation, and reflective practice. Through science we hope to inspire curiosity and depth of understanding.

It is our intent as a committee to challenge our students and assist our teachers by providing the strongest curriculum guidance infused with our faith. In the end, we hope to produce students formed by Catholic philosophies who will be equipped to solve problems, think deeply, and make informed, scientifically literate decisions rooted in responsibility. Our students will be well prepared to face the world in every regard.

Sincerely,

MaryBeth Mueller

MaryBeth Mueller, Ed. Specialist
Executive Director of the Division of Education and Evangelization
and Superintendent of Catholic Schools.

ELEMENTARY SCIENCE
CURRICULUM STANDARDS COMMITTEE
2013-2015

Enrique Diaz St. Vincent de Paul School Phoenix	Adriana Mattei Our Lady of Perpetual Help School Scottsdale
Maribeth Kilcoyne St. Theresa School Phoenix	Annette McDonough Our Lady of Mt. Carmel School Tempe
Katie MacDonald St. Theresa School Phoenix	Dr. Karl Ochsner St. John XXIII School Scottsdale
Camille Malkoon Our Lady of Perpetual Help School Scottsdale	Patrice Whalen St. John Bosco School Phoenix
Karen Marshall St. John XXIII School Scottsdale	Andrea Cuellar Our Lady of Perpetual Help Glendale
Setasha Bybee St. Jerome Catholic School Phoenix	Roy Regalato St. John Bosco School Phoenix
Mrs. Colleen McCoy-Cejka, M.A. Assistant Superintendent Diocese of Phoenix	Sr. Melita Penchalk, OSBM, Ed.S. Former Assistant Superintendent Diocese of Phoenix

Special Thanks!
The Catholic Schools Office would like to express deepest gratitude to Father Tom Eckert, pastor of St. Vianney Catholic Church and School, for spending time on the Catholic Identity review of these standards. His time and recommendations are appreciated!

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Diocese of Phoenix Science Curriculum K-12

Philosophy Statement

The universe is a place subject to fundamental scientific principles. An understanding of these principles will better prepare an individual to cope with a world in which rapid technological developments are taking place. As knowledge rapidly expands, it is most important for students to learn to make rational and moral decisions based upon scientific principles and their Catholic values. The skills and knowledge afforded students to make these types of decisions should reflect an appropriate level of intellectual and emotional growth. This curriculum is designed to stimulate curiosity and to develop morally responsible, scientifically literate citizens. This curriculum stresses the process of science as a way of learning and further emphasizes that scientific knowledge is always subject to change based on additional knowledge.

GOALS

All students will:

1. Develop an understanding of the processes and skills necessary for scientific investigation, problem solving, and critical thinking.

2. Develop responsible Catholic decision making skills in matters related to science and technology's impact on society with respect for the environment and all living things.

3. Recognize that science integrates mathematics, reading, oral and written communication, which are influenced by religious beliefs.

4. Develop interest, wonder, and curiosity about the study of the universe while recognizing the objective nature of science as created by God.

5. Develop an understanding of the scientific process and the structure of science, which includes organizing data into facts, principles, models, laws, and theories.

6. Realize the practical application of science in everyday life through technology and engineering.

Explanation of Engineering Standards

Engineering standards do not have a separate section in the Livebinders for lesson plans. These standards should be considered by teachers when lesson planning and integrated into lessons as seen fit along the way. They are not to be approached as separate from the curriculum but connected in a natural way. The goal is embed a deep understanding of each of the ETS standards within students for each section (K-2, 3-5, 6-8) by the end of each three year cycle.

National Standards and Benchmarks for effective Catholic Elementary and Secondary Schools March 2012

Academic Excellence:

The United States Conference of Catholic Bishops affirms the message of the Congregation on Catholic Education that intellectual development of the person and growth as a Christian go forward hand in hand. Rooted in the mission of the Church, the Catholic school brings faith, culture and life together in harmony. In 2005, the bishops noted that "young people of the third millennium must be a source of energy and leadership in our church and our nation. And, therefore, we must provide young people with an academically rigorous and doctrinally sound program of education" *(Renewing Our Commitment to Catholic Elementary and Secondary School is in the Third Millennium, 2005).*

The essential elements of "an academically rigorous and doctrinally sound program" mandate curricular experiences-including co-curricular and extra-curricular activities-which are rigorous, relevant, research-based, and infused with Catholic faith and traditions. The following essential elements provide a framework for the design, implementation, and assessment of authentic academic excellence in Catholic school education from pre-kindergarten through secondary school.

Standard 7: An excellent Catholic school has a clearly articulated, rigorous curriculum aligned with relevant standards, 21st century skills, and Gospel values, implemented through effective instruction. ***BENCHMARKS:***

7.1	The curriculum adheres to appropriate, delineated standards, and is vertically aligned to ensure that every student successfully completes a rigorous and coherent sequence of academic courses based on the standards and rooted in Catholic values.
7.2	Standards are adopted across the curriculum, and include integration of the religious, spiritual, moral, and ethical dimensions of learning in all subjects.
7.3	Curriculum and instruction for the 21st century learning provide students with the knowledge, understanding and skills to become creative, reflective, literate, critical, and moral evaluators, problem solvers, decision makers, and socially responsible global citizens.
7.4	Curriculum and instruction for 21st century learning prepares students to become expert users of technology, able to create, publish, and critique digital products that reflect their understanding of the content and their technological skills.
7.5	Classroom instruction is designed to intentionally address the effective dimensions of learning, such as intellectual and social dispositions, relationship building, and habits of mind.
7.6	Classroom instruction is designed to engage and motivate all students, addressing the diverse needs and capabilities of each student, and accommodating students with special needs as fully as possible.
7.7	Faculty collaborate in professional learning communities to develop, implement and continuously improve the effectiveness of the curriculum and instruction to result in high levels of student achievement.
7.8	The faculty and professional support staff meet (arch) diocesan, state, and/or national requirements for academic preparation and licensing to ensure their capacity to provide effective curriculum and instruction.
7.9	Faculty and professional support staff demonstrate and continuously improve knowledge and skills necessary for effective instruction, cultural sensitivity, and modeling of Gospel values.
7.10	Faculty and staff engage in high quality professional development, including religious formation, and are accountable for implementation that supports student learning.

Standard 8: An excellent Catholic school uses school-wide assessment methods and practices to document student learning and program effectiveness, to make student performances transparent, and to inform the continuous review of curriculum and the improvement of instructional practices. BENCHMARKS:

8.1	School-wide and student data generated by a variety of tools are used to monitor, review, and evaluate the curriculum and co-curricular programs; to plan for continued and sustained student growth; and to monitor and assess faculty performance.
8.2	School-wide and aggregated student data are normed to appropriate populations and are shared with all stakeholders.
8.3	Faculty use a variety of curriculum-based assessments aligned with learning outcomes and instructional practices to access student learning, including formative, summative, authentic performance, and student self-assessment.
8.4	Criteria used to evaluate student work and the reporting mechanisms are valid, consistent, transparent, and justly administered.
8.5	Faculty collaborate in professional learning communities to monitor individual and class-wide student learning through methods such as common assessments and rubrics.

Standard 9 An excellent Catholic school provides programs and services aligned with the mission to enrich the academic program and support the development of student and family life. BENCHMARKS*:*

9.1	School-wide programs for parents/guardians provide opportunities for parents/guardians to partner with school leaders, faculty, and other parents/guardians to enhance the educational experiences for the school community.
9.2	Guidance services, wellness programs, behavior management programs, and ancillary services provide the necessary support for students to successfully complete the school program.
9.3	Co-curricular and extra-curricular activities provide opportunities outside the classroom for students to further identify and develop their gifts and talents and to enhance their creative, aesthetic, social/emotional, physical, and spiritual capabilities.

INTRODUCTION

Science Teachers as Moral Educators ***Updated 2015***

The introduction of ethics in science classes is not the only way to portray science as receptive to open-mindedness and critical questioning. But it is an effective way, and it places science squarely in the context in which it actually operates in society. In addition, the very methods of inquiry and standards of public reasoning that science advances can make a valuable contribution to the moral education of students, beginning whenever the study of science begins.

Although ethical questions cannot be answered by science alone it seems clear that a reasonable approach to an ethical question requires carefully attending to, and seeking out, all the relevant facts.* We strive to seek God in all things, recognizing parents as the primary moral educators of the child.**

**Michael S. Pritchard*
http://www.onlineethics.org/CMS/edu/precol/childrenreason.aspx#teacher

***(The Catechism of the Catholic Church #2221)*

THE SCIENCE PROCESS TERMINOLOGY

The processes of science are skills that develop knowledge, concepts, and application across the curriculum. The processes are often referred to as the "hands-on" laboratory approach to science and must be used throughout the program. Each of the terms has been adapted from American Association for the Advancement of Science and Science Curriculum Improvement Studies and implies active student participation.

OBSERVING: Using the senses to gather information about objects and events in the environment. This skill includes using scientific instruments to extend the range of the human senses and the ability to differentiate relevant from non-relevant.

INQUIRING: Emanates from a student generated question. The student desires to understand scientific ideas or to develop knowledge. The student develops authentic, real world investigations which foster a deeper understanding.

CLASSIFYING: A method for establishing order on collections of objects or events. Students use classification systems to identify objects or events, to show similarities, differences, and interrelationships. It is important to realize that all classification systems are subjective and may change as criteria change. The test for a good classification system is whether others can use it.

MEASURING: A procedure for using instruments to determine the length, area, volume, mass, or other physical properties of an unknown quantity. It requires the proper use of instruments and the ability to calculate the measured results.

QUANTIFYING: The skill includes: number sense, computation, estimation, spatial sense, and higher order mathematical operations.

COMMUNICATING: Transmitting the results of observations and experimental procedures to others through the use of such devices as: graphs, charts, tables, written descriptions, technology, oral presentations, expository writing, etc. Communication is fundamental to science, because it is in exchanging ideas and results of experiments that knowledge is validated by others.

QUESTIONING: The formulating of original questions based on observations and experiences with an event in such a way that one can experiment to seek the answers.

RELATING: In the sciences, information about relationships can be descriptive or experimental. relationships are based on logical arguments that encompass all data. Hypothetical reasoning, deductive reasoning, coordinate graphing, the managing of variables, and the comparison of effects of one variable upon another contribute to understanding the major concepts of science.

INFERRING: An inference is a tentative explanation that is based on partial observations. Available data is gathered and an evaluation made based on the observed data. These judgments are never absolute and reflect what appears to be the most probable explanation at the time and are subject to change as new data is accumulated.

PREDICTING: Using previously-observed information to determine probable outcomes about future events.

FORMULATING HYPOTHESES: Stating a probable outcome for an occurrence based on observations and inferences. The validity of the hypothesis is determined from testing and data analysis.

IDENTIFYING AND CONTROLLING VARIABLES: Determining what elements in a given investigation will vary or change and what will remain constant. Ideally scientists will attempt to identify all the variables before an investigation is conducted. By manipulating one variable at a time they can determine how that variable will affect the outcome.

EXPERIMENTING*:* Experimentation often begins with observations, which lead to questions that need answers. The steps for proceeding may include forming a hypothesis, identifying and controlling variables, designing the procedure for conducting tests, implementing tests, collecting and interpreting the data and reaching a conclusion.

APPLYING*:* The process of inventing, creating, problem solving, and determining probabilities are applications of using knowledge to discover further information.

CONSTRUCTING MODELS: Developing physical or mental representations to explain an idea, object or event. Models are usually developed on the basis of an acceptable hypothesis.

SCIENCE CURRICULUM STANDARDS
Grades K-8

CODE:	
Elementary Science Standards 1.S5.C2.DPO1 (2008) = Grade 1, Strand 5, Concept 2, Diocesan Performance Objective 1. Explanations and Related materials are color coded:	
Green	Catholic Identity
Orange	Science and Engineering Practices
Blue	Disciplinary ideas
Highlighted sections show Diocesan curriculum committee additions.	

*The highlighted sections were added by the committee due to a recognition that content that they viewed as crucial had been omitted by the NGSS. Additionally, there are a number of NGSS that were omitted by the diocesan curriculum committee because they were viewed as developmentally inappropriate or contrary to the teachings of the Catholic faith.

Note to the teachers:
In developing the 2015 science standards for the Catholic Schools of the Diocese of Phoenix, the science teachers of the committee recognized the recurring theme of student-led discovery learning. While there is merit and research to support the importance of student engagement through developing models and trial and error through testing hypotheses, we want to make it clear that it is with the support of the teachers' expertise and guidance that students must still experience a good amount of instruction, assessment, and evaluation of the quality of solutions attempted through discovery. We also believe it is essential that the teacher is the moral guide in the classroom to guide students' understanding of the moral and ethical aspects of science. These elements of the Diocesan curriculum are the core of our mission and may not be found in your textbooks or in your teaching materials. Therefore, it is with great faith that we place the intent of the Diocesan curriculum in the hands of our teachers to teach process, content, and effective problem solving through high expectations and with the Catholic worldview at the center of it all.

Grade K Science Standards and DPOs

K.Forces and Interactions: Pushes and Pulls

Students who demonstrate understanding can:

K.PS2.1.	**Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.** [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [*Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.*]
K.PS2.DPO.1.	**Demonstrate the various ways that objects can move (e.g. straight line, zigzag, back-and-forth, round-and-round, fast, slow.** ***Formerly 1.S5.C2.DPO1.***
K.PS2.2.	**Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.*** [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [*Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.*]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• Share materials and work together in small groups, listen to the ideas of others. Show respectful interaction. • Use simple tools to make tasks easier. Use God given intellect to approach the tasks.	**Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • With guidance, plan and conduct an investigation in collaboration with peers. (K.PS2.1) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended. (K.PS2.2) - ***Connections to the Nature of Science*** **Scientific Investigations Use a Variety of Methods** • Scientists use different ways to study the world. (K.PS2.1)	**PS2.A: Forces and Motion** • Pushes and pulls can have different strengths and directions. (K.PS2.1), (K.PS2.2) • Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. (K.PS2.1),(K.PS2.2) **PS2.B: Types of Interactions** • When objects touch or collide, they push on one another and can change motion. (K.PS2.1) **PS3.C: Relationship Between Energy and Forces** • A bigger push or pull makes things speed up or slow down more quickly. *(secondary to K.PS2.1)* **ETS1.A: Defining Engineering Problems** A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. *(secondary to K.PS2.2)*

K. Interdependent Relationships in Ecosystems: Animals, Plants, and their Environment

Students who demonstrate understanding can:

K.LS1.1.	**Use observations to describe patterns of what plants and animals (including humans) need to survive.** [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]
K.LS1. DPO1.	**Identify plants and animals that exist in the local environment.** ***Formerly 1.S4.C3.DPO1***
K.LS1.DPO2.	**Compare habitats (e.g. desert, forest, prairie, water underground) in which plants and animals live.** ***Formerly 1.S4.C3.DPO2.***
K.ESS2.2.	**Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.** [Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.]
K.ESS2.DPO1.	**Describe how plants and animals within a habitat are dependent on each other.** ***Formerly 1.S4.C3. DPO3.***
K.ESS3.1.	**Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.** [Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and, grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.]
K.ESS3.DPO1.	**Know that animals require air, water, food, and shelter; plants require air, water, nutrients, and light.** ***Formerly 1.S4.C3.DPO4.***
K.ESS3.3.	**Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.*** [Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]
K.ESS3.DPO2.	**Identify ways to conserve natural resources (e.g. reduce, reuse, recycle, find alternatives.** ***Formerly 1.S6.C1.DPO5.***

Catholic Identity	**Science and Engineering Practices**	**Disciplinary Ideas**
• Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. • Understand that all plants and animals are part of God's creation. • Identify practices of good stewardship and responsible conservation of resources (e.g., reduce, reuse, and recycle). • Discuss reverence for all God's creations. • Identify how humans differ from other living things because of their heart, mind, and soul.	**Developing and Using Models** Analyzing Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, storyboard) that represent concrete events or design solutions. • Use a model to represent relationships in the natural world. (K.ESS3.1) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K.LS1.1)	**LS1.C: Organization for Matter and Energy Flow in Organisms** • All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. (K.LS1.1) **ESS2.E: Biogeology** • Plants and animals can change their environment. (K.ESS2.2) **ESS3.A: Natural Resources** • Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K.ESS3.1)

(Continued)

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
	Connections to the Nature of Science **Engaging in Argument from Evidence** Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). • Construct an argument with evidence to support a claim. (K.ESS2.2) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. • Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas. (K.ESS3.3) - *Connections to Nature of Science* **Scientific Knowledge is Based on Empirical Evidence** Scientists look for patterns and order when making observations about the world. (K.LS1.1)	**ESS3.C: Human Impacts on Earth Systems** • Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (K.ESS3.3) **ETS1.B: Developing Possible Solutions** Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.*(secondary to K.ESS3.3)*

K. Weather and Climate

Students who demonstrate understanding can:

K.PS3.1.	**Make observations to determine the effect of sunlight on Earth's surface.** [Clarification Statement: Examples of Earth's surface could include sand, soil, rocks, and water] [*Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.*]
K.PS3.DPO1.	**Identify evidence that the Sun is the natural source of heat and light on the Earth (e.g., warm surfaces, shadows, shade).** ***Formerly 1.S6.C2.DPO1.***
K.PS3.2.	**Use tools and materials provided to design and build a structure that will reduce the warming effect of sunlight on Earth's surface.*** [Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun.]
K.ESS2.1.	**Use and share observations of local weather conditions to describe patterns over time.** [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon and the number of sunny days versus cloudy days in different months.] [*Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.*]
K.ESS2.DPO1.	**Identify the following characteristics of seasonal weather patterns: temperature, type of precipitation, and wind.** ***Formerly 1.S6.C3.DPO1.***
K.ESS2.DPO2.	**Analyze how the weather affects daily activities.** ***Formerly 1.S6.C3.DPO2.***
K.ESS3.2.	**Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.*** [Clarification Statement: Emphasis is on local forms of severe weather.]
K.ESS3.DPO1.	**Know that short-term weather conditions (e.g. temperature, rain, snow) can change daily and weather patterns can change over the seasons.** ***Formerly 1.S6.C3.DPO3.***

The performance expectations developed using the following elements from the NRC document *A Framework for K-12 Science Education*

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Show respect to others. Treat others as you want to be treated.
- Share Biblical stories related to weather and climate: creation story or Noah. Consider what it would be like to spend 40 days out in the desert.
- How do other life forms utilize the sun for sustenance?
- Relate various seasons to different cycles of the Church.
  - Why did God create the sun?
  - What do we use the sun for?
  - What other life forms, (e.g. plants and insects) need the sun?

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.

- Ask questions based on observations to find more information about the designed world. (K. ESS3.2)

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K.PS3.1)

Disciplinary Ideas

PS3.B: Conservation of Energy and Energy Transfer

- Sunlight warms Earth's surface. (K.PS3.1),(K.PS3.2)

ESS2.D: Weather and Climate

- Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. (K.ESS2.1)

ESS3.B: Natural Hazards

- Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events. (K.ESS3.2)

(Continued)

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
	Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K.ESS2.1) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem. (K.PS3.2) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. • Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world. (K.ESS3.2) - ***Connections to Nature of Science*** **Scientific Investigations Use a Variety of Methods** • Scientists use different ways to study the world. (K.PS3.1) **Science Knowledge is Based on Empirical Evidence** Scientists look for patterns and order when making observations about the world. (K.ESS2.1)	**ETS1.A: Defining and Delimiting an Engineering Problem** • Asking questions, making observations, and gathering information are helpful in thinking about problems. *(secondary to K.ESS3.2)*

K-2 Engineering Design

Students who demonstrate understanding can:

K-2.ETS1.1.	**Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.**
K-2.ETS1.2.	**Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.**
K-2.ETS1.3.	**Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. • Use simple tools to make tasks easier. Use God given intellect to approach the tasks. • Consider Biblical stories that highlight building, moving structures, etc., such as the building of the pyramids. (Consider: Can a mountain be moved? A building? A brick? Demonstrate.) • Compare engineering design and God's intellectual design of life forms. • Compare designs of cathedral structures and their components. Use blocks to show complexity of design elements.	**Asking Questions and Defining Problems** Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions. • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2.ETS1.1) • Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2.ETS1.1) **Developing and Using Models** Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. • Develop a simple model based on evidence to represent a proposed object or tool. (K-2.ETS1.2) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended. (K-2.ETS1.3)	**ETS1.A: Defining and Delimiting Engineering Problems** • A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2.ETS1.1) • Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2.ETS1.1) • Before beginning to design a solution, it is important to clearly understand the problem. (K-2.ETS1.1) **ETS1.B: Developing Possible Solutions** • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2.ETS1.2) **ETS1.C: Optimizing the Design Solution** • Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2.ETS1.3)

Grade 1 Science Standards and DPOs

1. Waves: Light and Sound

Students who demonstrate understanding can:

1.PS4.1.	**Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.** [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]
1.PS4.1.DPO1.	**Demonstrate that vibrating objects produce sound.** ***Formerly 3.S5.C3.DPO3.***
1.PS4.2.	**Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.** [Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]
1.PS4.2.DPO1.	**Describe how light behaves on striking objects that are: Transparent (clear plastic), Translucent (waxed paper), Opaque (cardboard).** ***Formerly 3.S5.C3.DPO2.***
1.PS4.3.	**Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.** [Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).] [*Assessment Boundary: Assessment does not include the speed of light.*]
1.PS4.4.	**Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.*** [Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string "telephones," and a pattern of drum beats.] [*Assessment Boundary: Assessment does not include technological details for how communication devices work.*]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. • Describe how suitable tools help make better observations and measurements. • 4.2DPO1—Reference the rainbow, God's covenant. • 4.2DPO1—Reference and show stained glass windows and the process of light passing through transparent and translucent glass.	**Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • Plan and conduct investigations collaboratively to produce evidence to answer a question. (1.PS4.1),(1.PS4.3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.	**PS4.A: Wave Properties** • Sound can make matter vibrate, and vibrating matter can make sound. (1.PS4.1) **PS4.B: Electromagnetic Radiation** • Objects can be seen if light is available to illuminate them or if they give off their own light. (1.PS4.2) • Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.) (1.PS4.3)

(Continued)

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
	• Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1.PS4.2) • Use tools and materials provided to design a device that solves a specific problem. (1.PS4.4) - ***Connections to Nature of Science*** **Scientific Investigations Use a Variety of Methods** • Science investigations begin with a question. (1.PS4.1) • Scientists use different ways to study the world. (1.PS4.1)	**PS4.C: Information Technologies and Instrumentation** People also use a variety of devices to communicate (send and receive information) over long distances. (1.PS4.4)

1.Structure, Function, and Information Processing

Students who demonstrate understanding can:

1.LS1.1.	**Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.*** [Clarification Statement: Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]
1-LS1-1-DPO1.	**Identify the following as characteristics of living things: Growth and Development, Reproduction, Response to Stimulus.** ***Formerly 1.S4.C1.DPO1.***
1.-LS1-1-DPO2.	**Compare the following observable features of living things: Movement (legs, wings), Protection (skin, feathers, tree bark), Respiration (lungs, gills), Support (plant stems, tree trunks).** ***Formerly 1.S4.C1.DPO2.***
1.LS1.1.DPO3.	**Identify observable similarities and differences (e.g., number of legs, body, coverings, size) between/among different groups of animals.** ***Formerly 1.S4.C1.DPO3.***
1.LS1.1.DPO4.	**Understand the function and importance of the five senses.** ***Formerly 1.S4.C1.DPO4.***
1.LS1.2.	**Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.**[Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) and the responses of the parents (such as feeding, comforting, and protecting the offspring).]
1.LS1.2.DPO1.	**Identify stages of human life (e.g., infancy, adolescence, adult).** ***Formerly 1.S4.C2.DPO1.***
1.LS3.1.	**Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.** [Clarification Statement: Examples of patterns could include features plants or animals share. Examples of observations could include leaves from the same kind of plant are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same.] [*Assessment Boundary: Assessment does not include inheritance or animals that undergo metamorphosis or hybrids.*]
1.LS3.1.DPO1.	**Identify similarities and differences between animals and their parents.** ***Formerly 1.S4.C2.DPO2.***

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Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. • Use simple tools to make tasks easier. Use God given intellect to approach the tasks. • Understand that God created man in his own image. • Reference Genesis. Identify aspects of the creation story and how all living things came to be. • Use the five senses to appreciate skin, fur, feathers, etc. in understanding the creation story. • Consider "creating"animals from materials and the care that goes into forming a creation. Consider how a creator cares for a creation and keeps it safe?	**Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1.LS3.1) • Use materials to design a device that solves a specific problem or a solution to a specific problem. (1.LS1. 1) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.	**LS1.A: Structure and Function** • All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1.LS1.1) **LS1.B: Growth and Development of Organisms** • Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1.LS1.2)

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
	• Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world. (1.LS1.2) - *Connections to Nature of Science* **Scientific Knowledge is Based on Empirical Evidence** • Scientists look for patterns and order when making observations about the world. (1.LS1.2)	**LS1.D: Information Processing** • Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1.LS1.1) **LS3.A: Inheritance of Traits** • Young animals are very much, but not exactly like, their parents. Plants also are very much, but not exactly, like their parents. (1.LS3.1) **LS3.B: Variation of Traits** • Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways. (1.LS3.1)

1. Space Systems: Patterns and Cycles

Students who demonstrate understanding can:

1.ESS1.1.	**Use observations of the sun, moon, and stars to describe patterns that can be predicted.** [Clarification Statement: Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars other than our sun are visible at night but not during the day.] [*Assessment Boundary: Assessment of star patterns is limited to stars being seen at night and not during the day.*]
1.ESS1.1.DPO1.	**Compare celestial objects (e.g., Sun, Moon, stars) and transient objects in the sky (e.g., clouds, birds, airplanes, contrails).** ***Formerly 1.S6.C2.DPO2.***
1.ESS1.1.DPO2.	**Describe observable changes that occur in the sky. (e.g., clouds forming and moving, the position of the Moon.** ***Formerly 1.S6.C2.DPO3.***
1.ESS1.1.DPO3.	**Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations (e.g., Sally Ride [scientist], Neil Armstrong [astronaut, engineer].** ***Formerly 1.S2.C1.DPO2.***
1.ESS1.2.	**Make observations at different times of year to relate the amount of daylight to the time of year.** [Clarification Statement: Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.] [*Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.*]

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Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. • Reference creation of the sun and moon in Genesis. • Reference the star of Bethlehem as the heavenly body that brought the wise men to Jesus and the stars as the guide for Columbus crossing the ocean. • Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations using God's gifts (e.g., Sally Ride [scientist], Neil Armstrong [astronaut, engineer]. They were inspired by their intellect and drawn to the heavens out of curiosity. • Introduce the term "Heavenly Bodies" and explain the phrase in relation to their place in the universe.	**Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (1.ESS1.2) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (1.ESS1.1)	**ESS1.A: The Universe and its Stars** • Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. (1.ESS1.1) **ESS1.B: Earth and the Solar System** • Seasonal patterns of sunrise and sunset can be observed, described, and predicted. (1.ESS1.2)

K-2 Engineering Design

Students who demonstrate understanding can:

K-2.ETS1.1.	**Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.**
K-2.ETS1.2.	**Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.**
K-2.ETS1.3.	**Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

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Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. • Use simple tools to make tasks easier. Use God given intellect to approach the tasks. • Consider Biblical stories that highlight building, moving structures, etc., such as the building of the pyramids. (Consider: Can a mountain be moved? A building? A brick? Demonstrate.) • Compare engineering design and God's intellectual design of life forms. • Compare designs of cathedral structures and their components. Use blocks to show complexity of design elements.	**Asking Questions and Defining Problems** Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions. • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2.ETS1.1) • Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2.ETS1.1) **Developing and Using Models** Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. • Develop a simple model based on evidence to represent a proposed object or tool. (K-2.ETS1.2) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended. (K-2.ETS1.3)	**ETS1.A: Defining and Delimiting Engineering Problems** • A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2.ETS1.1) • Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2.ETS1.1) • Before beginning to design a solution, it is important to clearly understand the problem. (K-2.ETS1.1) **ETS1.B: Developing Possible Solutions** • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2.ETS1.2) **ETS1.C: Optimizing the Design Solution** • Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2.ETS1.3)

Grade 2 Science Standards and DPOs

2. Structure and Properties of Matter

Students who demonstrate understanding can:

2.PS1.1.	**Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.** [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]
2.PS1.1.DPO1.	**Know that different objects are made up of many different types of materials (e.g., cloth, paper, wood, metal) and have many different observable properties (e.g., color, size, shape, weight).** ***Formerly 1.S5.C1.DPO3.***
2.PS1.1.DPO2.	**Describe objects in terms of measurable properties (e.g., length, volume, weight, temperature) using scientific tools.** ***Formerly 2.S5.C1.DPO1.***
2.PS1.2.	**Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [*Assessment Boundary: Assessment of quantitative measurements is limited to length.*]
2.PS1.2.DPO1.	**Compare the following physical properties of basic Earth materials: color, texture, capacity to retain water.** ***Formerly 1.S6.C1.DPO2.***
2.PS1.3.	**Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]
2.PD1.3.DPO1.	**Identify common uses (e.g., construction, decoration) of basic Earth materials (e.g., rocks, water, soil).** ***Formerly 1.S6.C1.DPO3.***
2.PS1.4.	**Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.** [Clarification Statement: Examples of reversible changes could include materials such as water and butter at different temperatures. Examples of irreversible changes could include cooking an egg, freezing a plant leaf, and heating paper.]
2.PS1.4.DPO2.	**Classify materials solids, liquids, or gases.** ***Formerly 2.S5.C1.DPO2.***
2.PS1.4.DPO3.	**Know that water can be a liquid or a solid and can be made to change from one form to the other, but the amount of water stays the same.** ***Formerly 2.S5.C1.DPO3.***
2.PS1.4.DPO4.	**Demonstrate that water can exist as a: gas-vapor, liquid-water, solid-ice. Formerly 2.S5.C1.DPO4.**
2.PS1.4.DPO5.	**Demonstrate that solids have a definite shape and that liquids and gases take the shape of their containers.** ***Formerly 2.S5.C1.DPO5.***

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Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• Listen respectfully to others when they present their findings. Ask appropriate questions. Be respectful. Treat others as you would like to be treated. • Reference the omnipotence and power of God in the multiplying loaves and fishes, the parting of the Red Sea, and water to wine at the wedding at Cana stories (and others). Compare the reality of physical properties, such as melting, freezing, and evaporating, and compare how God's intervention, miracles, can defy natural order.	**Planning and Carrying Out Investigations** • Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.	**PS1.A: Structure and Properties of Matter** • Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (2.PS1.1)

(Continued)

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• In preparation for receiving the Eucharist, reference the concept of Transubstantiation as a miracle that happens at mass. Man cannot change a physical property without changing its components, but God can and does when the body and blood change into Jesus.	• Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.(2.PS1.1) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended. (2.PS1.2) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. • Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2.PS1.3) **Engaging in Argument from Evidence** Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing ideas and representations about the natural and designed world(s). • Construct an argument with evidence to support a claim. (2.PS1.4) - ***Connections to Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • Science searches for cause and effect relationships to explain natural events. (2.PS1.4)	**PS1.A: Structure and Properties of Matter** • Different properties are suited to different purposes. (2.PS1.2),(2.PS1.3) • A great variety of objects can be built up from a small set of pieces. (2.PS1.3) **PS1.B: Chemical Reactions** • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (2.PS1.4)

2. Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

2.LS2.1.	**Plan and conduct an investigation to determine if plants need sunlight and water to grow.** [*Assessment Boundary: Assessment is limited to testing one variable at a time.*]
2.LS2.2.	**Develop a simple model that mimics the function of an animal in dispersing seeds or Pollinating plants.***
2.LS4.1.	**Make observations of plants and animals to compare the diversity of life in different habitats.** [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [*Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.*]
2.LS4.1.DPO1.	**Identify some plant and animals that exist in the local environment.** ***Formerly 1.S4.C3.DPO1.***
2.LS4.1.DPO2.	**Compare the habitats (e.g., desert, forest, prairie, water, underground) in which plants and animals live.** ***Formerly 1.S4.C3.DPO2.***
2.LS4.1.DPO3.	**Describe how plants and animals within a habitat are dependent on each other.** ***Formerly 1.S4.C3.DPO3.***
2.LS4.1.DPO4.	**Compare life cycles of various plants (e.g., conifers, flowering plants, ferns).** ***Formerly 3.S4.C2.DPO1***
2.LS4.1.DPO5.	**Explain how growth, death, and decay are part of the plant life cycle.** ***Formerly 3.S4.C2.DPO2.***

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Listen respectfully to others when they present their findings. Ask appropriate questions. Be respectful. Treat others as you would like to be treated.
Understand that plants are a part of God's creation and require us to care for them.
Reference Genesis: In the Garden of Eden, everything was given to Adam and Eve. Once they were banished, they had to work the land. Make a connection to gardening, the cycle of life and death related to growth and decay.
Compare the death and resurrection to the life cycle of a perennial flower (i.e. tulip) or tree that dies and revives with the seasons.

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Developing and Using Models
<u>Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.</u>

<u>Develop a simple model based on evidence to represent a proposed object or tool. (2.LS2.2)</u>

<u>Planning and Carrying Out Investigations</u>
<u>Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.</u>

<u>Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2.LS2.1)</u>
<u>Make observations (firsthand or from media) to collect data which can be used to make comparisons. (2.LS4.1)</u>

- -
Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

Scientists look for patterns and order when making observations about the world. (2.LS4.1)

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<u>LS2.A: Interdependent Relationships in Ecosystems</u>

<u>Plants depend on water and light to grow. (2.LS2.1)</u>
<u>Plants depend on animals for Pollination or to move their seeds around. (2.LS2.2)</u>

<u>LS4.D: Biodiversity and Humans</u>

<u>There are many different kinds of living things in any area, and they exist in different places on land and in water. (2.LS4.1)</u>

<u>ETS1.B: Developing Possible Solutions</u>
<u>Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.</u>(secondary to 2.LS2.2)
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2.Earth's Systems: Processes that Shape the Earth

Students who demonstrate understanding can:

2.ESS1.1.	**Use information from several sources to provide evidence that Earth events can occur quickly or slowly.** [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [*Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]
2.ESS1.1.DPO1.	**Classify objects by the following observable properties: shape, texture, size, color, weight.** ***Formerly 1.S5.C1.DPO1.***
2.ESS1.1.DPO2.	**Describe the following basic Earth materials: rocks, soil, water.** ***Formerly 1.S6.C1.DPO1.***
2.ESS2.1.	**Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.***[Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]
2.ESS2.2.	**Develop a model to represent the shapes and kinds of land and bodies of water in an area.** [*Assessment Boundary: Assessment does not include quantitative scaling in models.*]
2.ESS2.3.	**Obtain information to identify where water is found on Earth and that it can be solid or liquid.**
2.ESS2.3.DPO1.	**Classify materials as solids and liquids.** ***Formerly 1.S5.C1.DPO2.***

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- Listen respectfully to others when they present their findings. Ask appropriate questions. Be respectful. Treat others as you would like to be treated.
- Relate God's creation and design to current earth systems and structures.

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Developing and Using Models
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a model to represent patterns in the natural world. (2.ESS2.2)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations from several sources to construct an evidence-based account for natural phenomena. (2.ESS1.1)
- Compare multiple solutions to a problem. (2.ESS2.1)

Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information.

- Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question. (2.ESS2.3)

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ESS1.C: The History of Planet Earth

- Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (2.ESS1. 1)

ESS2.A: Earth Materials and Systems

- Wind and water can change the shape of the land. (2.ESS2.1)

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- Maps show where things are located. One can map the shapes and kinds of land and water in any area. (2.ESS2.2)

ESS2.C: The Roles of Water in Earth's Surface Processes

- Water is found in the ocean, rivers, lakes, and Ponds. Water exists as solid ice and in liquid form. (2.ESS2.3)

ETS1.C: Optimizing the Design Solution
Because there is always more than one possible solution to a problem, it is useful to compare and test designs. *(secondary to 2.ESS2.1)*

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K-2 Engineering Design

Students who demonstrate understanding can:

K-2.ETS1.1.	**Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.**
K-2.ETS1.2.	**Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.**
K-2.ETS1.3.	**Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*

Catholic Identity	Science and Engineering Practices	Disciplinary Ideas
• Share materials and work together in small groups, listen to the ideas of others. Be respectful. Treat others as you would like to be treated. • Use simple tools to make tasks easier. Use God given intellect to approach the tasks. • Consider Biblical stories that highlight building, moving structures, etc., such as the building of the pyramids. (Consider: Can a mountain be moved? A building? A brick? Demonstrate.) • Compare engineering design and God's intellectual design of life forms. • Compare designs of cathedral structures and their components. Use blocks to show complexity of design elements.	**Asking Questions and Defining Problems** Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions. • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2.ETS1.1) • Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2.ETS1.1) **Developing and Using Models** Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. • Develop a simple model based on evidence to represent a proposed object or tool. (K-2.ETS1.2) **Analyzing and Interpreting Data** Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended. (K-2.ETS1.3)	**ETS1.A: Defining and Delimiting Engineering Problems** • A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2.ETS1.1) • Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2.ETS1.1) • Before beginning to design a solution, it is important to clearly understand the problem. (K-2.ETS1.1) **ETS1.B: Developing Possible Solutions** • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2.ETS1.2) **ETS1.C: Optimizing the Design Solution** • Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2.ETS1.3)

Third Grade

Essential questions answered in Third Grade Science Curriculum:

- How can the impact of weather-related hazards be reduced?
- How do organisms vary in their traits?
- How are plants, animals, and environments of the past similar or different from current plants, animals, and environments?
- What happens to organisms when their environment changes?
- How do equal and unequal forces on an object affect the object?
- How can magnets be used in third grade?
- What is God's design for the environment?
- In what ways does our Catholic faith influence our view of the natural world?

Grade 3 Science Standards and DPOs

3. Forces and Interactions

Students who demonstrate understanding can:	
3.PS2.1.	**Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.** [Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.] [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.]
3.S5.C2.DPO1.	**Define and describe the forces of gravity and friction. *(Formerly 5.S5.C2.DPO1)***
3.PS2.2.	**Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.** [Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.] [Assessment Boundary: Assessment does not include technical terms such as period and frequency.]
3.PS2.3.	**Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.** [Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]
3.S5.C3.DPO4.	**Investigate the characteristics of magnets (e.g., opposite poles attract, like poled repel, the force between two magnets poles depends on the distance between them). *(Formerly 4.S5.C.3.DPO4)***
3.S5.C3.DPO 5.	**State cause and effect relationships between magnets and circuitry. (Formerly 4.S5.C3.DPO5)**
3.PS2.4.	**Identify and explain a simple design problem that can be solved by applying scientific ideas about magnets.*** [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Place physical obstacles between a magnet and a metal object. Explain that the greater the object (or obstacle/sin) the more difficult it is for us to feel the draw of God. Talk about obstacles or sins that can keep us from feeling God's invitation for love.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. • Ask questions that can be investigated based on patterns such as cause and effect relationships. (3.PS2.3) • Define a simple problem that can be solved through the development of a new or improved object or tool. (3.PS2.4) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3.PS2.1) • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3.PS2.2) -- **Connections to Nature of Science** **Science Knowledge is Based on Emperical Evidence** • Science findings are based on recognizing patterns. (3.PS2.2) • Scientific Investigations Use a Variety of Methods **Science investigations use a variety of methods, tools, and techniques. (3.PS2.1)**	**PS2.A: Forces and Motion** • Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.) (3.PS2.1) • The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.) (3.PS2.2) **PS2.B: Types of Interactions** • Objects in contact exert forces on each other. (3.PS2.1) • Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3.PS2.3),(3.PS2.4)	**Patterns** • Patterns of change can be used to make predictions. (3.PS2.2) **Cause and Effect** • Cause and effect relationships are routinely identified. (3.PS2.1) • Cause and effect relationships are routinely identified, tested, and used to explain change. (3.PS2.3) ----------------------***Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology*** Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3.PS2.4)

3. Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:	
3.LS2.1.	**Construct an argument that some animals form groups that help members survive.**
3.LS4.1.	**Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]
3.S6.C1.DPO4.	**Describe fossils as a record of past forms.**
3.S6.C1.DPO5.	**Describe how fossils are formed.**
3.LS4.3.	**Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]
3.S4.C3.DPO1.	**Identify the living and nonliving components of an ecosystem.**
3.S4.C3.DPO2.	**Describe the components of an ecosystem.**
3.S4.C3.DPO3.	**Examine an ecosystem to identify microscopic and macroscopic organisms.**
3.S4.C3.DPO1.1.	**Describe ways various resources (e.g., air, water, plants , animals, soil) are utilized to meet the needs of population.** ***(Formerly 4.S4.C3.DPO 1)***
3.S4.C3.DPO3.1.	**Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment.** ***(Formerly 4.S4.C3.DPO3)***
3.LS4.4.	**Defend the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*** [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]
3.S4.C3.DPO6.	**Describe how plants and animals cause changes in their environment.**
3.S4.C3.DPO7.	**Describe how environmental factors (e.g., soil composition, range of temperature, quantity and quality of light) in the ecosystem may affect a member organism's ability to grow, reproduce, and thrive**.

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Understand that all plants and animals are God's creation and require us to care for it.
- Recognize we are stewards of all God's creation and that we were made in His image and likeness.
- Identify causes and effect of hunger in the world.
- Describe the development of different technologies (medicine, communication, entertainment, transportation) in response to resources, needs and values.
- Find out how students in your school can help families affected by a natural disaster. Plan a way to help in a small way. Propose a solution, resource, or product that addresses a specific human, animal, or habitat need.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches tocollecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Analyze and interpret data to make sense of phenomena using logical reasoning. (3.LS4.1) **Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed worlds. • Construct an argument with evidence, data, and/or a model. (3.LS2.1) • Construct an argument with evidence. (3.LS4.3) • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4)	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3.LS4.4) **LS2.D: Social Interactions and Group Behavior** • Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. *(Note: Moved from K–2) (3.LS2.1)* **LS4.A: Evidence of Common Ancestry and Diversity** • Some kinds of plants and animals that once lived on Earth are no longer found anywhere. *(Note: Moved from K–2) (3.LS4.1)* • Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3.LS4.1) **LS4.C: Adaptation** • For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3) **LS4.D: Biodiversity and Humans** • Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3.LS4.4)	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change. (3.LS2.1),(3.LS4.3) • Scale, Proportion, and Quantity Observable phenomena exist from very short to very long time periods. (3.LS4.1) **Systems and System Models** • A system can be described in terms of its components and their interactions. (3.LS4.4) --- ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • Knowledge of relevant scientific concepts and research findings is important in engineering. (3.LS4.4) ------------***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural System** Science assumes consistent patterns in natural systems. (3.LS4.1)

3. Inheritance and Variation of Traits: Life Cycles and Traits

3.LS1.1.	**Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.** [Clarification Statement: Changes organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.]
3.S4.C2.DPO1.	**Compare life cycles of various plants (e.g., conifers, flowering plants, ferns)**
3.S4.C2.DPO2.	**Explain how growth and decay are part of the plant life cycle.**
3.LS3.1.	**Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]
3.S4.C2.DPO3.	**Define the terms heredity and genes. *(Formerly 5.S4.C2.DPO1.)***
3.S4.C2.DPO4.	**Distinguish between physical characteristics which are and are not inherited. (Formerly 5.S4.C2.DPO2)**
3.LS3.2.	**Use evidence to support the explanation that traits can be influenced by the environment.** [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]
3.LS4.2.	**Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing**. [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Recognize that we all have special gifts and talents from God.
- Emphasize the unique trait of having a soul that is specific to humans.
- Recognize respect for all living things as God's creations.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop models to describe phenomena (3.LS1.1) **Analyzing and Interpreting Data** Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Analyze and interpret data to make sense of phenomena using logical reasoning. (3.LS3.1) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in onstructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Use evidence (e.g., observations, patterns) to support an explanation. (3.LS3.2) • Use evidence (e.g., observations, patterns) to construct an explanation. (3.LS4.2) -- Connections to Nature of Science Science Knowledge is Based on Empirical Evidence	**LS1.B: Growth and Development of Organisms** Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3.LS1.1) **LS3.A: Inheritance of Traits** • Many characteristics of organisms are inherited from their parents. (3.LS3.1) • Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3.LS3.2) **LS3.B: Variation of Traits** • Different organisms vary in how they look and function because they have different inherited information. (3.LS3.1) • The environment also affects the traits that an organism develops. (3.LS3.2) **LS4.B: Natural Selection** • Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (3.LS4.2)	**Patterns** • Similarities and differences in patterns can be used to sort and classify natural phenomena. (3.LS3.1) • Patterns of change can be used to make predictions. (3.LS1.1) **Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change. (3.LS3.2),(3.LS4.2) -------------------------- *Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World* • Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3.ESS3.1) -------------*Connections to Nature of Science* **Science is a Human Endeavor** Science affects everyday life. (3.ESS3.1)

3. Weather and Climate

Students who demonstrate understanding can:

3.ESS2.1.	**Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.** [Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]
3.S6.C3.DPO5.	**Interpret the symbols on a weather map or chart to identify the following: temperatures, fronts, precipitation**. (*Formerly* ***4.S6.C3.DPO5.)***
3.ESS2.2.	**Obtain and combine information to describe climates in different regions of the world.**
3.S6.C3.DPO6.	**Compare weather conditions and various conditions (e.g., regions of Arizona, various U.S. cities, coastal vs. interior geographical regions).** ***(Formerly 4.S6.C3.DPO6.)***
3.ESS3.1.	**Defend the merit of a design solution that reduces the impacts of a weather-related hazard.*** [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Evaluate the consequences of environmental occurrences that happen either rapidly or over a long period of time and how we are called in solidarity to help those involved in these events.
- Reference the Corporal and Spiritual Works of Mercy to enhance discussion about the impact of severe weather conditions on living things throughout the world.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3.ESS2.1) **Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3.ESS3.1) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. • Obtain and combine information from books and other reliable media to explain phenomena. (3.ESS2.2)	**ESS2.D: Weather and Climate** • Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3.ESS2.1) • Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3.ESS2.2) **ESS3.B: Natural Hazards** • A variety of natural hazards result from natural processes.Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3.ESS3.1) (Note: This Disciplinary Core Idea is also addressed by 4.ESS3.2.)	**Patterns** • Patterns of change can be used to make predictions. (3.ESS2.1),(3.ESS2.2) **Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. (3.ESS3.1) --------------------------- *Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World* • Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3.ESS3.1) --------------*Connections to Nature of Science* **Science is a Human Endeavor** • Science affects everyday life. (3.ESS3.1

3. Engineering Design

Students who demonstrate understanding can:

3-5.ETS1.1.	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5.ETS1.2.	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5.ETS1.3.	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Be respectful and treat others as you wish to be treated.
- Use the God given gift of intellect to be resourceful and use simple tools to make tasks easier.
- Consider the pastoral as well as the practical nature of the problems and solutions we address.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5.ETS1.1) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5.ETS1.3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5.ETS1.2)	**ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5.ETS1.1) **ETS1.B: Developing Possible Solutions** • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5.ETS1.2) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2) • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5.ETS1.3) **ETS1.C: Optimizing the Design Solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5.ETS1.3)	**Influence of Science, Engineering, and Technology on Society and the Natural World** • People's needs and wants change over time, as do their demands for new and improved technologies. (3-5.ETS1.1) • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5.ETS1.2)

Fourth Grade

Essential questions for Fourth Grade Science Curriculum:

- How can the impact of weather-related hazards be reduced?
- What are waves and what are some things they can do?
- How can water, ice, wind, and vegetation change the land?
- What patterns of Earth's features can be determined with the use of maps?
- How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?
- What is energy and how is it related to motion?
- How is energy transferred?
- How can energy be used to solve a problem?
- What can people do to preserve God's natural creations?
- How can people be protectors and good stewards of God's resources?

Grade 4 Science Standards and DPOs

4. Energy

Students who demonstrate understanding can:	
4.PS3.1.	**Use evidence to construct an explanation relating the speed of an object to the energy of that object.** [Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.]
4.PS3.2.	**Make conclusions based on observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.** [Assessment Boundary: Assessment does not include quantitative measurements of energy.]
4.S5.C3.DPO2.	**Describe how energy is transferred by using Scientific Method. *(Formerly 5.S5.C3.DPO2.)***
4.PS3.3.	**Ask questions and predict outcomes about the changes in energy that occur when objects collide.** [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]
4.PS3.4.	**Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*** [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]
4.S5.C3.DPO1.	**Demonstrate that electricity flowing in circuits can produce light, heat, sound, and magnetic effects.**
4.ESS3.1.	**Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.** [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]
4.S4.C3.DPO2.	**Differentiate renewable resources from nonrenewable resources.**
4.S4.C3.DPO3.	**Analyze the effect that limited resources (e.g., natural gas, minerals) may have on an environment.**

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Plan and implement responsible stewardship of God's natural resources.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4.PS3.3) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4.PS3.2) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4.PS3.1) • Apply scientific ideas to solve design problems. (4. PS3.4) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluate the merit and accuracy of ideas and methods. • Obtain and combine information from books and other reliable media to explain phenomena. (4.ESS3.1)	**PS3.A: Definitions of Energy** The faster a given object is moving, the more energy it possesses. (4.PS3.1) nergy can be moved from place to place by moving objects or through sound, light, or electric currents. (4.PS3.2),(4.PS3.3) **PS3.B: Conservation of Energy and Energy Transfer** • Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4.PS3.2),(4.PS3.3) • Light also transfers energy from place to place. (4.PS3.2) • Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4.PS3.2),(4.PS3.4) **PS3.C: Relationship Between Energy and Forces** • When objects collide, the contact forces transfer energy so as to change the objects' motions. (4.PS3.3) **PS3.D: Energy in Chemical Processes and Everyday Life** • The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4.PS3.4) **ESS3.A: Natural Resources** • Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4.ESS3.1) **ETS1.A: Defining Engineering Problems** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). • Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4.PS3.4)	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change. (4.ESS3.1) **Energy and Matter** • Energy can be transferred in various ways and between objects. (4.PS3.1), (4. PS3.2), (4.PS3.3), (4. PS3---.4) ----------------***Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology*** • Knowledge of relevant scientific concepts and research findings is important in engineering. (4.ESS3.1) Influence of Engineering, Technology, and Science on Society and the Natural World • Over time, people's needs and wants change, as do their demands for new and improved technologies. (4.ESS3.1) • Engineers improve existing technologies or develop new ones. (4.PS3.4) -------------------------------------***Connections to Nature of Science*** **Science is a Human Endeavor** • Most scientists and engineers work in teams. (4.PS3.4) Science affects everyday life. (4.PS3.4)

4. Waves: Waves and Information

Students who demonstrate understanding can:	
4.PS4.1.	**Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.** [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]
4.PS4.1.1.	**Discuss how changes in amplitude and wavelength can affect how an object moves.**
4.PS4.3.	**Generate and compare multiple solutions that use patterns to transfer information.*** [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. ▪ Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. ▪ Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3) -- *ConnectionstoNatureofScience* **Scientific Knowledge is Based on Empirical Evidence** ▪ Science findings are based on recognizing patterns. (4-PS4-1)	**PS4.A: Wave Properties** ▪ Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. *(Note: This grade band endpoint was moved from K–2).* (4-PS4-1) ▪ Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1) **PS4.C: Information Technologies and Instrumentation** ▪ Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4-PS4-3) **ETS1.C: Optimizing The Design Solution** ▪ Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. *(secondary to 4-PS4-3)*	***Patterns*** • *Similarities and differences in patterns can be used to sort and classify natural phenomena.(4-PS4-1)* • *Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3)* --- ***Connections to Engineering, Technology ,and Applications of Science*** ***Interdependence of Science, Engineering, and Technology*** *Knowledge of relevant scientific concepts and research findings is important in engineering.(4-PS4-3)*

4. Structure, Function, and Information Processing

Students who demonstrate understanding can**:**	
4.PS4.2.	**Develop a model to explain and discuss that light reflecting from objects and entering the eye allows objects to be seen.** [Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]
4.LS1.1.	**Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]
D3.S4.C1.DPO1.	**Describe the function of the following plant structures: roots-absorb nutrients, stems-provide support, leaves-synthesize food, flowers-attract pollinators and produce seeds for reproduction.**
D4.S4.C1.DPO1.	**Compare structures in plants (e.g., roots, stems, leaves, flowers)**
D4.S4.C1.DPO2.	**Compare structures in animals (e.g., muscles, bones, nerves) that serve different functions in growth and survival.**
4.LS1.2.	**Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.** [Clarification Statement: Emphasis is on systems of information transfer.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]of the skeleta
4.LS4.1.1	Identify the functions and parts of the skeletal system: protection- rib cage, cranium; support- vertebrae; movement- pelvis, femur, hip
4.LS4.1.2	Identify the following types of muscles: cardiac- heart; smooth- stomach; skeletal –biceps
4.LS4.1.3	Identify the functions and parts of the nervous system: control center –brain; relay mechanism –spinal cord; transport messages –nerves
4.LS4. 1.4	Distinguish between voluntary and involuntary responses.

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Recognize that in God’s infinite wisdom He created all living creatures with senses that enable them to survive.
- Respect life at all stages, as a gift given freely by God.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Engineering Practices **Developing and Using Models** Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model to describe phenomena. (4.PS4.2) • Use a model to test interactions concerning the functioning of a natural system. (4.LS1.2) **Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Construct an argument with evidence, data, and/or a model. (4.LS1.1)	**PS4.B: Electromagnetic Radiation** • An object can be seen when light reflected from its surface enters the eyes. (4.PS4.2) **LS1.A: Structure and Function** • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4.LS1.1) **LS1.D: Information Processing** • Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4.LS1.2)	**Patterns** • Cause and effect relationships are routinely identified. (4.PS4.2) **Systems and System Models** A system can be described in terms of its components and their interactions. (4.LS1.1), (4.LS1.2)

4. Earth's Systems: Processes that Shape the Earth

Students who demonstrate understanding can:	
4.ESS1.1.	**Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.** [Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.]
4.ESS2.1.	**Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.** [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]
4.S6.C2.DPO1.	**Identify the Earth processes that cause erosion.**
4.S6.C2.DPO2.	**Describe how currents and wind cause erosion and land changes.**
4.S6.C2.DPO3.	**Describe the role that water plays in the following processes that alter the Earth's surface features: erosion, deposition, weathering.**
4.ESS2.2.	**Analyze and interpret data from maps to describe patterns of Earth's features.** [Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]
4.ESS3.2.	**Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.*** [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Evaluate the consequences of environmental occurrences that happen either rapidly or over a long period of time and how we are called in solidarity to help those involved in these events.
- Find out how students in your school can help families affected by a natural disaster. Plan a way to help.
- Become lifelong stewards who gratefully share the gifts of time, talent, and treasure.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4.ESS2.1) **Analyzing and Interpreting Data** Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Analyze and interpret data to make sense of phenomena using logical reasoning. (4.ESS2.2) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Identify the evidence that supports particular points in an explanation. (4.ESS1.1) • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4.ESS3.2)	**ESS1.C: The History of Planet Earth** • Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4.ESS1.1) **ESS2.A: Earth Materials and Systems** • Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4.ESS2.1) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** • The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the • boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4.ESS2.2) **ESS2.E: Biogeology** • Living things affect the physical characteristics of their regions. (4.ESS2.1) **ESS3.B: Natural Hazards** • A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards • but can take steps to reduce their impacts. (4.ESS3.2) (Note: This Disciplinary Core Idea can also be found in 3.WC.) **ETS1.B: Designing Solutions to Engineering Problems** • Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4.ESS3.2)	**Patterns** • Patterns can used as evidence to support and explanation. (4.ESS1.1),(4.ESS2.2) **Cause and Effect** • Cause and effect relationships are routinely identified, tested and use to explain change. (4.ESS2.1),(4.ESS3.2) --- ***Connections to Engineering, Technology ,and Applications of Science*** ***Interdependence of Science, Engineering, and Technology*** **Influence of Engineering, Technology, and Science on Society and the Natural World** • Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4.ESS3.2) ***Connections to Nature and Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural systems.** Science assumes consistent patterns and natural systems. (4.ESS1.1)

4. Engineering Design

Students who demonstrate understanding can:	
3-5.ETS1.1.	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5.ETS1.2.	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5.ETS1.3.	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Be respectful and treat others as you wish to be treated.
- Use the God given gift of intellect to be resourceful and use simple tools to make tasks easier.
- Consider the pastoral as well as the practical nature of the problems and solutions we address.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5.ETS1.1) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5.ETS1.3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5.ETS1.2)	**ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5.ETS1.1) **ETS1.B: Developing Possible Solutions** • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5.ETS1.2) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5.ETS1.2) • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5.ETS1.3) **ETS1.C: Optimizing the Design Solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5.ETS1.3)	**Influence of Science, Engineering, and Technology on Society and the Natural World** • People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5.ETS1.1) • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5.ETS1.2)

Fifth Grade

The performance expectations in fifth grade help students formulate answers to questions such as:

- When matters changes, does its weight change?
- How much water can be found in different places on Earth?
- Can new substances be created by combining other substances?
- How does matter cycle through ecosystems?
- Where does the energy in food come from and what is it used for?
- How do lengths and directions of shadows or relative lengths of day and night change from day to day, and how does the appearance of some stars change in different seasons?
- What miracles seem to exist in God's design of interworking ecosystems?

5. Structure and Properties of Matter

Students who demonstrate understanding can:	
5.PS1.1.	**Create a model to explain that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.]
5.S5.C1.DPO1.	**Identify that matter is made of smaller units called: molecules and atoms.**
5.PS1.2.	**Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.** [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.]
5.PS1.3.	**Make observations and measurements to identify materials based on their properties.** [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.]
5.PS1.4.	**Conduct an investigation to determine whether the mixing of two or more substances results in new substances.**
5S5.C1.DPO2.	**Distinguish between mixtures and compounds.**

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Discuss how evidence, observations, and logic are essential to scientific explanations, but not necessarily a part of belief based explanations (e.g. You don't need to see God to believe in Him.)
- Reference the story of Doubting Thomas who had to see the Risen Lord in order to believe. Faith, in any discipline, is believing and knowing without actually seeing.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. Develop a model to describe phenomena. (5.PS1.1) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5.PS1.4) • Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5.PS1.3) **Using Mathematics and Computational Thinking** Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. • Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5.PS1.2)	**PS1.A: Structure and Properties of Matter** • Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (5.PS1.1) • The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5.PS1.2) • Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5.PS1.3) **PS1.B: Chemical Reactions** • When two or more different substances are mixed, a new substance with different properties may be formed. (5.PS1.4) • No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) (5.PS1.2)	**Cause and Effect** • Cause and effect relationships are routinely identified, test, and used to explain change. (5.PS1.4) **Scale, Proportion, and Quantity** • Natural Objects exist from the very small to the immensely large. (5.PS1.1) • Standard units are used to measure and describe physical quantities such as weight, time, temperature, volume. (5.PS1.2),(5.PS1.3)

5. Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:	
5.PS3.1.	**Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.** [Clarification Statement: Examples of models could include diagrams, and flow charts.]
5.LS1.1.	**Support an argument that plants get the materials they need for growth chiefly from air and water.** [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]
5.LS2.1.	**Create a model to describe the movement of matter among plants, animals, decomposers, and the environment.** [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]
5.S4.C3.DPO5	**Explain the interrelationships among plants and animals in different environments: producers, consumers, decomposers. (Formerly 3.S4.C3.DPO5.)**

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Understanding that all plants and animals are God's creation.
- Define and apply stewardship to all life on earth.
- Respect life at all stages as a gift given freely by God.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Use models to describe phenomena. (5.PS3.1) • Develop a model to describe phenomena. (5.LS2.1) **Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Support an argument with evidence, data, or a model. (5.LS1.1) --- **Connections to Nature of Science** **Science Models, Laws, Mechanisms, and Theories** **Explain Natural Phenomena** • Science explanations describe the mechanisms for natural events. (5.LS2.1)	**DPS3.D: Energy in Chemical Processes and PS3.D: Energy in Chemical Processes and Everyday Life** • The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5.PS3.1) **LS1.C: Organization for Matter and Energy Flow in Organisms** • Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5.PS3.1) • Plants acquire their material for growth chiefly from air and water. (5.LS1.1) **LS2.A: Interdependent Relationships in Ecosystems** • The food of almost any kind of animal can be traced back toplants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. • Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relativelystable web of life. Newly introduced species can damage the balance of an ecosystem. (5.LS2.1) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** • Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5.LS2.1)	**Systems and System Models** **Systems and System Models** • A system can be described in terms of its components and their interactions. (5.LS2.1) **Energy and Matter** • Matter is transported into, out of , and within systems. (5.LS1.1) • Energy can be transferred in various ways and between objects. (5.PS3.1)

5. Earth Systems

Students who demonstrate understanding can:	
5.ESS2.1.	**Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.** [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.]
5.ESS2.2.	**Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.** [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.]
5.S6.C3.DPO2.	**Describe the distribution of water on the Earth's surface. (Formerly 4.S6.C3.DPO2.)**
5.ESS3.1.	**Obtain and compare information about ways individual communities use science ideas to protect the Earth's resources and environment.**

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Take this opportunity to develop an understanding of what it means to be responsible stewards of God's earthly gifts, both as individuals and as communities.
- Propose a solution, resource, or product that addresses a specific solution to protect the earth's resources and environment.
- Evaluate the possible strengths and weaknesses of a proposed solution relevant to protecting the earth's resources and environment.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model using an example to describe a scientific principle. (5.ESS2.1) **Using Mathematics and Computational Thinking** Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions. • Describe and graph quantities such as area and volume to address scientific questions. (5.ESS2.2) **Obtaining, Evaluating, and ommunicating Information** Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. • Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5.ESS3.1)	**ESS2.A: Earth Materials and Systems** • Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5.ESS2.1) **ESS2.C: The Roles of Water in Earth's Surface Processes** • Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5.ESS2.2) **ESS3.C: Human Impacts on Earth Systems** • Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5.ESS3.1)	**Scale, Proportion, and Quantity** • Standard units are used to measure and describe physical quantities such as weight and volume. (5.ESS2.2) **Systems and System Models** • A system can be described in terms of its components and their interactions. . (5.ESS2.1),(5.ESS3.1) • -- ***Connections to Nature of Science*** • **Science Addresses Questions About the Natural and Material World** Science findings are limited to questions that can be answered within Empirical Evidence. (5. ESS3.1)

5. Space Systems: Stars and the Solar System

Students who demonstrate understanding can:	
5.PS2.1.	**Support an argument that the gravitational force exerted by Earth on objects is directed toward the center of the planet.** [Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]
5.ESS1.1.	**Support an argument that differences in the brightness of the sun compared to other stars is due to their relative distances from Earth.** [Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).]
5.ESS1.2.	**Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]
5.S.6.C2.DPO1.	**Describe how the Moon's appearance changes during a four-week lunar cycle.**
5.S.6.C2.DPO2.	**Describe how Earth's rotation results in day and night at any particular location.**
5.S.6.C2.DPO3.	**Distinguish between revolution and rotation.**

Catholic Identity

- If students are using technology/devices, they should demonstrate Catholic responsibility through proper use of digital communication and apply digital citizenship.
- Students will relate Easter to the lunar cycle recognizing that Easter is held on the first Sunday After the first full moon occurring on or after the vernal equinox.
- Relate the story in Genesis to Earth's rotation resulting in day and night.
- Reference how the days get shorter during Advent in relation to winter solstice and shortest day of the year while waiting for the light of Christ as Christmas.

5. Engineering Design

Students who demonstrate understanding can:	
3-5.ETS1.1.	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5.ETS1.2.	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5.ETS1.3.	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Catholic Identity

- Share materials and work together in small groups, listen to the ideas of others. Be respectful and treat others as you wish to be treated.
- Use the God given gift of intellect to be resourceful and use simple tools to make tasks easier.
- Consider the pastoral as well as the practical nature of the problems and solutions we address.

Science and Engineering Practices	Disciplinary Ideas	Crosscutting Concepts
Asking Questions and Defining Problems Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships. • Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5.ETS1.1) **Planning and Carrying Out Investigations** Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5.ETS1.3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5.ETS1.2)	**ETS1.A: Defining and Delimiting Engineering Problems** • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5.ETS1.1) **ETS1.B: Developing Possible Solutions** • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5.ETS1.2) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5.ETS1.2) • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5.ETS1.3) **ETS1.C: Optimizing the Design Solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5.ETS1.3)	**Influence of Science, Engineering, and Technology on Society and the Natural World** • People's needs and wants change over time, as do their demands for new and improved technologies. (3-5.ETS1.1) • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5.ETS1.2)